THIOURACIL STUDIES IN THE FATTENING OF SWINE

BY

STANLEY WALLACE TERRILL

B.S., Iowa State College, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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R. UNIV. BIBLIOTHEEK LEIDEN

THIOURACIL STUDIES IN THE FATTENING OF SWINE

Since MacKenzie, MacKenzie and McCollum (1941) demonstrated that sulfanilylguanidine suppressed thyroid action in the rat, considerable interest has developed in the feeding of goitrogenic compounds to farm animals to study the effect on rate of growth, rate of fattening, efficiency of feed utilization, carcass quality, animal activity and physiological functions. Thiouracil (2-thio-6 oxypyrimidine) and related compounds inhibit the production of thyroid hormone by the thyroid gland.

The possibility that the ingestion of thiouracil may result in a more rapid rate of fattening and a lower intake of feed for each unit of gain has been investigated by several workers using different species of farm animals. Conflicting results have been reported.

The purpose of this investigation was to study the effect of thiouracil-feeding on rate of gain, efficiency of gain, feed consumption, carcass characteristics, carcass composition and nitrogen utilization of fattening swine. A preliminary test with white rats and 7 experiments with swine were conducted. Approved statistical methods were used to evaluate the data.

In the pilot test, 16 young male white rats were pair-fed for 9 weeks to study the effect of 0.2% thiouracil on rate of gain, nitrogen retention, voluntary activity, body length and body composition. The thiouracil rats (1) gained significantly more rapidly than controls during the first and second weeks, (2) retained slightly less nitrogen and gained significantly slower than controls during the 5-day collection periods in the third, fourth and fifth weeks, (3) exercised significantly less than controls while in activity cages the last 5 weeks of the test, (4) averaged 0.3 cm. shorter in final body length (odds 1:15) and (5) differed very little from controls in body composition.

A total of 41 Duroc barrows were used in 2 paired-feeding trials and a trio-feeding test, each of 6 weeks' duration, to determine the optimum level of thiouracil to include in the ration for fattening swine weighing 140 to 180 pounds initially. This weight range was selected because it was expected that thiouracil would be most effective when fed to animals after skeletal and muscular growth had slackened. Rate of gain was the criterion. In the first test, 0.2% thiouracil produced significantly more rapid gains than 0.1% of the drug. In a second test, 0.15% thiouracil was just as effective as 0.25% thiouracil in promoting gains. In the trio-feeding test, pigs fed 0.15% thiouracil gained more rapidly than pigs fed 0.20% of the drug (odds 1:18) and gained at a highly significant increased rate over the controls.

A total of 42 fattening pigs were used in a group-feeding test and an individual-feeding test, each of 6 weeks' duration, to determine the effect of 0.15% thiouracil on rate of gain, feed consumption and efficiency of gains of full-fed pigs. In the group-feeding test, the thiouracil pigs (1) showed no significant increase in cumulative gains over controls, but gained significantly slower than controls during the fifth and sixth weeks, (2) consumed an average of 1.5 pounds less feed per pig daily than controls and (3) required 63 to 75 pounds less feed per 100 pounds of gain than controls when fed for 3 to 6 weeks. In the individual-feeding test, the thiouracil pigs (1) showed no significant increase in cumulative gains over controls, but gained significantly slower during the fifth and sixth weeks, (2) consumed an average of 1.7 pounds less feed per pig daily than controls (odds 1:589), consuming significantly less feed during the fourth, fifth and sixth weeks of test, and (3) required 54 to 75 pounds less feed per 100 pounds of gain than controls when fed for 3 to 6 weeks (odds $> 1:254$).

To determine the effect of 0.15% thiouracil on carcass composition, 7 pairs of barrows were pair-fed for equal gains during a 4-week period, were slaughtered, and the right half of each carcass was divided into mechanically separable lean, fat,

bone and skin. Samples of lean and fat from each carcass were analyzed for dry matter, ether extract and total nitrogen. No significant differences in physical or chemical carcass composition were noted. The 0.15% thiouracil ration was 1.15 times as effective as the control ration in promoting gains in this test.

Slaughter data, cutting yields and carcass measurements were obtained from the trio-feeding, group-feeding and the carcass composition tests. Barrows fed 0.15% thiouracil had significantly shorter and thicker carcasses and shorter legs than controls. The 0.8% to 1.0% lower dressing percentage of the thiouracil barrows approached significance with odds of 1:14 and 1:17 for cold and hot dressing percentages, respectively. Little difference was noted between the two groups in thickness of backfat, cutting yields, carcass grade and carcass firmness. Thiouracil barrows had significantly heavier thyroids.

To determine the effect of 0.15% thiouracil on the utilization of protein in the ration, nitrogen balance studies were made on 6 pairs of Duroc barrows for a 10-day period during the second and third weeks of thiouracil ingestion. The thiouracil barrows retained significantly more nitrogen than controls and gained at a very significantly increased rate over controls during the 10-day collection period; however, the control barrows retained significantly more nitrogen per pound of gain than did the thiouracil barrows. The body gains of the controls were calculated to contain about 2% more protein than the gains by the thiouracil barrows. No significant differences in apparent digestibility of nitrogen occurred. The control barrows consumed more water than the thiouracil barrows, but the difference was not significant.

In all of the swine tests, the pigs receiving 0.15% thiouracil made their most rapid gains during either the second or third weeks on test. The results of the group-feeding test suggest that breed and sex may be factors in the response of pigs to thiouracil.

CONCLUSIONS

Within the limits of the conditions covered in the study, the following conclusions appear justified:

1. The feeding of 0.2% thiouracil to young male white rats results in reduced voluntary activity, increased gains, shorter carcasses and little difference in body composition.

2. Of the levels of thiouracil tested (0.1%, 0.15%, 0.20%, and 0.25%), 0.15% represents the most nearly optimum level to add to an adequate ration for fattening barrows weighing 140 to 180 pounds initially. For the remaining purposes of this study, this level of the drug was selected to be fed.

3. Under conditions of equalized feed intake, thiouracil increases the rate of gain of pigs significantly and reduces the amount of feed consumed per unit of gain significantly.

4. When rations are fed to produce equal rates of gain, adding thiouracil to an adequate ration reduces significantly the amount of feed required.

5. When comparable pigs are fed to the limit of appetite either individually or in groups, adding thiouracil to an adequate ration does not increase the rate of gain but it does significantly reduce the feed consumption as well as the amount of feed required per unit of gain. Thus, the chief benefit from thiouracil under conditions of full-feeding is the increase in efficiency of gains rather than any increase in rapidity of gains.

6. The optimum length of time to feed thiouracil is about 4 weeks, since thiouracil significantly reduces feed consumption and daily gains of full-fed pigs after 4 weeks of feeding. However, advantage can be taken of the feed-saving feature of the drug for 6 weeks with little loss in over-all gains.

7. Thiouracil causes greater retention of nitrogen in the body during the second and third weeks of feeding, the period of time that the drug causes the greatest increase in daily gains.

8. Neither the physical nor the chemical carcass composition is modified significantly when pigs are fed to gain equally during a 4-week period.

9. Thiouracil causes partial inhibition of skeletal growth, lowers dressing percentage about 1% but has little effect on thickness of backfat, cutting yields, carcass grade or carcass firmness.

10. The results of the group-feeding test in which 3 breeds and 2 sexes were represented suggest that breed and sex may be factors in the response of pigs to thiouracil. Further investigation is needed to clarify this point.

REFERENCE

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VITA

Stanley Wallace Terrill was born on a farm near Redfield, Iowa, January 21, 1919. He attended the Rippey Consolidated School, Rippey, Iowa, for 12 years, graduating in 1936.

In September, 1936, he entered Iowa State College, graduating with the degree of Bachelor of Science in December, 1940.

From January, 1941, to September, 1941, he was employed as the Warren County Club Agent, Warren County, Iowa.

He enrolled in the Graduate School of the University of Illinois in September, 1941, and served as an Assistant in Animal Husbandry. From February, 1943, to February, 1946, he was on leave of absence for military service.

He was married to Miss Vivian LaVerne Benton, Springfield, Missouri, on May 28, 1943.

Upon returning from military service, he continued his graduate work toward the degree of Doctor of Philosophy and served as an Assistant in Animal Science. His graduate work consisted of a major in Animal Science, a first minor in Animal Nutrition and a second minor in Physiology.